ANALYSIS OF POLAR CAP ABSORPTION EVENTS III. TIME RELATION OF RF-Hα MAXIMUM INTENSITY FOR ALL CM BURSTS $\geq 500 \times 10^{-22}$ W(m^2c/s)-1

BY

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1.0 OBJECTIVES, RESULTS, AND CONCLUSIONS

During the analysis of flares of importance ≥ 3 it was found that if the time of the RF maximum flux at one or more of the frequencies 1420, 1500, 2000, 2800, 2980, 3000, or 3750 Mc/s preceded the time of the H α flare maximum, there was a probability of 90% that the flare would not be followed by a PCA event. Conversely, the time of RF peak flux followed the time of the H α flare maximum for 76.5% of the flares that were followed by a PCA event.

It was also found that:

87% of the flares that were followed by a PCA event the RF peak flux exceeded 500×10^{-22} W$(m^2c/s)^{-1}$

while

75% of non-PCA flares the associated RF peak flux was less than 500×10^{-22} W$(m^2c/s)^{-1}$

In order to increase the statistical significance, the study has been extended to all known cases where the peak flux at one or more of the selected frequencies in the decimeter and centimeter range from 1420 through 3750 Mc/s exceeded 500×10^{-22} W$(m^2c/s)^{-1}$ associated with flares of importance $\leq$ 2+.

This study added 180 new events to the 142 investigated in the previous study.

1.1 TIME RELATION OF FLARES, RF EMISSIONS AND KNOWN PCA EVENTS

We were able to find sufficient reliable data, including the start and time of maximum of the flare, the start and time of RF peak flux, and peak flux to determine with reasonable confidence the time between the peak RF flux

and the H α flare maximum for 113 cases. We were able to determine with reasonable confidence that 97 of these cases were not followed by a known PCA event. Nine were followed by an important PCA event and seven by a small or questionable PCA. From this analysis we find that 78% of all flares with RF peak flux* $\geq$ 500 x 10^{-22} $W(m^2c/s)^{-1}$ that were not followed by a PCA, the time of RF peak intensity preceded or coincided with the time of the flare maximum.

In the case of the minor flares that were followed by a PCA event we find only 44% where the time of the RF peak flux follow the time of Hα flare maximum.

This is in strong contrast with flares of importance $\geq$ 3 where (ref. 13) it was found that 76.5% of the flares that were followed by a PCA event, the time of RF peak flux followed the time of the H α flare maximum.

1.2 ANALYSIS OF FAILURES AND FALSE ALARMS

1.2.1 RF-Hα Failures

An RF-H α event is considered to be a failure if the event (with reasonable confidence) was followed by a PCA and the time of the RF peak intensity preceded the time of the H α flare maximum.

1.2.2 RF-H α False Alarm

The RF-H α event is considered to be a false alarm if the event is not followed by a known PCA and the time of RF peak intensity followed the time of H α flare maximum.

The 21 false alarms from the present study and the six from the previous study (ref. 13) and the failures from the two studies will be examined

* In our subsequent discussion we will use the term "flux units" where one flux unit is $10^{-22}W(m^2c/s)^{-1}$.

in greater detail during the next quarter in a search for additional necessary and/or sufficient conditions.

2.0 RF EMISSIONS WITH PEAK FLUX ≥ 500 FLUX UNITS ASSOCIATED WITH FLARES WITH IMPORTANCE ≤ 2+

Table 1 lists all RF emissions reported by at least one radio observatory in the frequencies range 1420 through 3750 Mc/s, with a peak flux ≥ 500 flux units associated with flares with importance ≤ 2+.

A total of 180 events were compiled from all available sources (references 4, 9, 10, 14 and 23). After a detailed analysis of all available data the RF events were classified as follows.

	No. Events	Sub Total	Grand Total
No flare patrol	15		
No flare reported, flare patrol probable	11		
Time of flare maximum not reported	17		
Time of RF peak not reported	13		
Flare-RF association or RF peak questionable	11		
Total insufficient data		67	
Flares not followed by a PCA	97		
Flares followed by a PCA event	16		
Total events for detailed study		113	
Total events			180

2.1 FLARES WITH MAJOR RF EMISSIONS NOT FOLLOWED BY A PCA EVENT

2.1.1 Delay Time Δ t Between Hα Flare Maximum and RF Peak Intensity

The time of all RF peak emissions reported by one or more of the seven frequencies tabulated in Table 1 were compared with the time of the Hα flare maximum and a value for Δ t was obtained (where Δ t equaled the time

of RF peak emission minus the time of the H α flare maximum). The algebraic value for Δ t was recorded for the emissions with peak flux $\geq$ 500 flux units only. In cases where a value could be obtained for more than one frequency, the value chosen for this analysis was restricted to only one frequency with preference given to 2800, 3750, or 3000 respectively. The number of events for each frequency that were chosen in this way, with the algebraic sign for Δ t are shown in Table 1.1.

Frequency	$\Delta t < 0$	$\Delta t = 0$	$\Delta t > 0$	Total
1420	1	0	0	1
1500	3	0	2	5
2000	1	0	2	3
2800	20	2	8	30
2980	6	0	0	6
3000 Tok	16	3	5	24
3000 HHI	2	0	2	4
3750	17	5	2	24
	66	10	21	97

TABLE 1.1

Number of RF-H α Events Not Followed by a PCA.
Analyzed at Each Frequency

The frequency distribution for RF-H α events followed by an important or a small PCA is shown in Table 1.2

Frequency	Important PCA		Small or Questionable PCA		
	$\Delta t \geq 0$	$\Delta t < 0$	$\Delta t \geq 0$	$\Delta t < 0$	Total
1420	1	0	2	0	3
1500	0	0	0	0	0
2000	0	0	0	0	0
2800	1	3	0	0	4
2980	0	0	0	0	0
3000 Tok	0	1	1	1	3
3000 HHI	0	0	0	0	0
3750	1	2	3	0	6
Total	3	6	6	1	16

TABLE 1.2

Number of Major RF-Hα Events Followed by a Known or Questionable PCA Analyzed at Each Frequency

The results of the present study which extends the analysis to all minor flares (importance $\leq$ 2+) with a peak flux $\geq$ 500 flux units at one or more of the chosen frequencies are shown in Figure 1a and Table 1.1. We find that for 78% of all of the flares that were not followed by a known PCA event the time of the peak RF intensity coincided with or preceded the time of the Hα flare maximum ($\Delta t \leq 0$).

2.1.2 Duration of the RF Bursts

The energy released at the time of a flare is directly proportional to the time integral of the RF flux.

The time durations together with the range of peak flux and the delay time between the RF peak intensity and the Hα flare maximum are shown on Figure 2 for the three classes of flares.

(a) Flares not followed by a PCA event.

(b) Flares followed by an important PCA.

(c) Flares followed by a small or questionable PCA event.

The data shown on this figure introduces a number of problems that will be discussed in detail in the next quarterly report.

These include:

(a) The 21 flares that were not followed by a known PCA event where the time of the RF peak intensity followed the time of the Hα flare maximum (the false alarms). In particular those events where the duration of the RF emission was greater than 20 minutes or the RF peak intensity exceeded 1000 flux units.

(b) Flares that were followed by a PCA event, where the time of peak RF flux preceded the time of the Hα flare maximum (the failures).

It was found (ref. 17) that all RF bursts at 2800 and 3750 Mc/s that were followed by PCA events for which time histories were available, the time integrated RF flux gave energies in excess of 10^{-17} joules $(m^2c/s)^{-1}$. Integrated RF energies were calculated for seven of the nine events (ref. 18) as shown in Table 2.1 below, with other data from Tables 1 and 2. We have also included the data for the event on 22 June 1957, for which a peak of 570 flux units was reported at 3000 Mc/s by Tokyo, a flux time history is not available at this time but an approximate energy value (peak flux x duration/2) is given. Bailey (ref. 2) gives an equivalent 30 Mc/s absorption of 5 db,

but indicated that this event might be a continuation of the weak event on the 19th. Neither Kahle (ref. 15) or Reid and Leinbach (ref. 21) give an absoprtion for the event on the 20th. It is quite probable that this was a small PCA event.

It is interesting to note that seven of the nine events occurred on the Eastern quadrant of the sun.

All of the events will be examined in detail in the next quarterly report.

Date	PCA Onset	Int.	RF Onset	Units Peak Int.	Dur.	Δt	Flare Max.	Imp.	CMD	Integrated Energy
6/19/57	2215	W	1609	2325	10	- 3	1613	2	E45	34
8/28/57	2400	3.2	2018	760	5	- 4	2024	2+	E30	10
8/20/58	21/1400	3.0	0042	1450	5	- 2	0044	2+	E18	15
9/03/60	0500	2.7	0039	12000	85	- 3	0108	2+	E88	160
9/10/61	2100	2.9	1930	880	61	- 9	2010	1	W80	95
6/22/57	0500	5.0	0231	570	21	- 3	0241	2	E12	(36)
2/09/58	10/0600	3.2	2138	856	32	+10	2142	2+	W14	
3/29/60	0800	2.6	0655	8250	52	+24	0710	2+	E30	915
3/30/60	2000	5.0	1518	640	22	--				
			1540	1750	60	+16	1540	2	E13	160
			1640		138					

TABLE 2.1

Summary of PCA Events Associated with Flares Importance $\leq$ 2+
with RF Peak $\geq$ 500 Flux Units with Integrated Energy
in Units 10^{-18} Joules $(m^2c/s)^{-1}$

2.1.3 Central Meridian Distance of Flares Associated with Major RF Bursts

Figure 3 does not indicate any real preferential central meridian distance for flares associated with the major RF bursts. The seven events at E60 and E70, Figure 3b, will be examined in more detail with the five events in the eastern quadrant of the sun shown on Figure 3e.

2.1.4 Time Distribution of All Bursts $\geq$ 500 Flux

Figure 4 shows a reasonable correlation between the number of RF events reported and the number of radio observatories normally observing during each hour of the universal day. The number of events during the times of no flare patrol or no flare reported shows a strong concentration during the first three hours of the universal day. This is in agreement with the analysis by Dodson and Hedeman (ref. 6) who found the least number of flares of all importance during the first five and last five hours of the universal day.

Figure 4 also shows that there were several periods during the universal day when RF patrol coverage was marginal.

An important PCA is indicated by the letter P in the appropriate box. The S indicates a small or questionable PCA. The PCA at 0400 on April 5, 1960, is not included, since the association of the RF emission starting at 0140 with the importance 2 flare which started sometime before 0215 is considered to be questionable. It is probable that the H α flare maximum occurred sometime before 0215.

2.2 FLARES WITH MAJOR RF EMISSIONS FOLLOWED BY A PCA EVENT

During the analysis of the RF-H α time association for flares of importance $\geq$ 3, it was found (ref. 13) that the time of the RF peak flux followed the time of H α maximum for 76.5% of the PCA flares.

The use of this criteria for classifying an RF-H α event as a probable PCA or a non PCA event is almost a complete failure (Fig. 1b) since only three of the nine important PCA are associated with a positive Δt. While in the case of the smallor questionable PCA events that could be associated with an RF-H α event six of the seven (Fig. 1c) were associated with a Δ t $\geq$ 0.

Figure 1d shows the RF-H α values for Δt for minor flares and RF emissions less than 500 flux units, where the values of Δt were positive for only three of the seven events.

The large percentage of failures associated with flares of importance $\leq$ 2+ may be due to questionable flare association, or failures to observe the true time of the flare maximum. This situation will be examined during subsequent investigations.

3.0 GENERAL DISCUSSION AND PROGRAM FOR THE NEXT QUARTER

3.1 COMPARISON OF PEAK FLUX REPORTED AT DIFFERENT FREQUENCIES

During the progress of this study it was noticed that a wide range of peak fluxes were reported at the different frequencies for a given event.

In particular it was found that for 47 of the events where both Tokyo (3000 Mc/s) and Nagoya (3750) reported peak fluxes, the peak reported at 3000 Mc/s was greater than the peak reported by Nagoya for 37 cases. In most cases the Tokyo values were greater than the Nagoya by a factor of at least two and in some cases by a factor of 10 or greater.

Figure 6 shows a scatter plot of the peak flux value at 3000 and 3750 Mc/s with the least squares fit. The reported times of the start of the emissions, and peak flux agree plus or minus a minute or so in all cases.

A corresponding comparison of peak fluxes at 2800 and 3750 Mc/s show an almost perfect correlation. Unfortunately, the total number of points is small since they were made near sunrise at 3750 and sunset at 2800. Only one event shows a large discrepancy (9/28/61 at 2211 UT) when a peak of 800 flux units was reported at 2800 Mc/s while a peak of 1690 was reported at 3750; Ottawa reported interference, consequently the real value of the peak flux may be much greater than 800.

Figure 7 shows a comparison of the daily mean flux for the first six months of the IGY. This shows an almost complete agreement between 2800 Mc/s and 3750 Mc/s while the Tokyo mean values average more than 100 flux units higher. However, the daily fluctuations at all of the frequencies are in complete agreement.

Figure 8 shows a similar comparison of the daily mean flux for last six months period of 1960 during the decline of solar activity from the

maximum toward minimum. It is seen that the close correlation of the flux at 2800 and 3750 Mc/s still exists while 3000 Mc/s remains high.

3.2 PROGRAM FOR THE NEXT QUARTER

3.2.1 Association of H α and Other Parameters with RF Time Histories

Wherever possible the time histories of the Hα -RF events will be examined in greater detail and the possibility that other minor flares preceding or during the time of the event may influence the classification of the event as a failure or false alarm or a questionable association will be investigated.

3.2.2 Investigation of Sunspot Characteristics

Several investigators have carried out a limited study of sunspot magnetic field configurations and have found a high probability that a proton producing flare will occur in sunspots with umbra of opposite polarity in the same penumbra (classified as a δ magnetic configuration). Sunspot groups associated with both RF-Hα failures and false alarms will be examined in all cases where Mt. Wilson sunspot drawings and magnetic field measurements were made.

It is anticipated that the many gaps in the Mt. Wilson data will greatly restrict the number of events that can be evaluated, and an effort will be made to fill the gaps with data from other observatories.

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TABLE I

RADIO EMISSIONS AT CENTIMETER WAVELENGTHS WITH PEAK FLUX $\geq 500 \times 10^{-22}$ $W(m^2c/s)^{-1}$ ASSOCIATED WITH FLARES OF IMPORTANCE < 3 DURING THE 19th SOLAR CYCLE

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s							PCA	
		Start	Duration Min.	Time Max UT	Position	Imp.	On-set	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration Min.	Peak Int.	Δ t ***	No.	Int.
	1955																					
1.	2/24	No flare patrol 0000 to 0500					None reported				0104 20/-		*3750	Mag	CD	0101.5	0102.5	2.5	1470	P		
2.	6/18	1904	36	1910	S22 W21	2+(3-)	1903	47	S	2+			*2800	Ott	ED	1906.5	1907.8	30.5	1580	-2.2		
3.	11/15	No flare patrol 1600 to 1800 UT					None reported						*2800	Ott	CA	1734	1737	5.0	565	P		
	1956																					
4.	2/16	1805	154	--	N22 E06	2+	1802	93	SL	3			*2800	Ott	CD	1756	1813	51.0	623	M_1		
5.	2/19	1430	147	1445	N25 W23	1+ (2)	1429	151	S	3			*2800	Ott	SD	1425	1435	29.0	643	-10		
6.	3/01	1730	15	--	N20 W55	2	1726	22	S	2			*2800	Ott	SD	1721	1724	5.0	614	M_1		
7.**	3/10	0515	85	--	N16 E88	2	0438	117	SL	3-			*3000	Tok	CD	0443	0518	80.0	850	M_1	2	3.5
													3750	Mag		0447	--	--	1000			
8.	3/13	1453	32	--	N21 E50	2	1452	118	S	3-			*2800	Ott	SD	1451	1454	14.5	860	M_1		
9.	3/15	1617	80	1635	N22 E21	2+ (3)	1623	120	S	3			*2800	Ott	SD	1621	1627	23.5	1320	-8		
																1644	1652	33.0	195			
10.	5/18	1600	10	--	S26 E45	1-	1605	15	S	1			1500	HNI								
													*2800	Ott	SD	1604.3	1604.4	15.7	515	M_1		
11.	5/30	No flare reported Probably no patrol					0230	95	S	3+			*3000	Tok	CD	0232.5	0235	14.5	690	P		
													3750	Mag	CD	0234		7.3	440			
12.	7/22	1624	56	1641	N29 W54	2 (2+)	1635	110	S	2+		(1638)	*2800	Ott	SD	1638	1641.8	8.5	660	+0.8		
															SD	1646.5	1648	11.5	389			
13.	11/08	0231	17	0242	N14 E62	1	0243	17	S	1			3000	Tok	CD	0223	0224	8.0	369			
													*		CD	0238	0245	10.0	538	+3		
													3750	Mag	CD	0241		4.8	74			
14.	11/22	1312	63	1341	S15 W83	2	1330	65	S	3		(1323)	2800	Ott	SA	1333	1334.7	3.0	17			
													*		SA	1336	1339	20.3	1000	-2.0		
15.	12/20	0432	15		N12 E15	1						(0444)	*3000	Tok	CD	0444	0451	24.0	530	-8		
		*0456	27	0459	S26 W90	1+ (2)	0442	81	S	3												
16.	12/26	1401	67	1412	S17 W11	2 (3)	1403	97	SL	3-		(1403)	*2800	Ott	CD	1403	1454	165.0	800	+42		
17.	12/29	0040	100	0045	N16 E59	1+	0044	106	S	3+		(0043)	*3000	Tok	CD	0043	0056	90.0	1150	+11		
													3750									
	1957																					
18.	1/05	No flare patrol from 1500 UT on the 4th to 0125 on the 5th					0050	63	SL	2+		(0050)	*3000	Tok	CD	0050	0056	58.0	501	P		
													3750									
19.	1/06	No flare patrol between 1500 and 2100 UT					1702	53	S	2+	1703	1711	*2800	Ott	SD	1701.5	1703.5	10.0	700			
											9/3+	169/3			CD	1719	1722.5	13.0	70	P		
															SD	1758	1827	92.0	585			
20.	1/24	1638	15	--	S28 W80	2	1638	27	S	2+			*2800	Ott	SD	1637	1638.8	10.0	1000	M_1		
21.	2/08	1550	25	1555	S28 E38	2	1552	10	S	2	1551		*2800	Ott	SD	1550	1551	6.0	865	-4		
											4/3+											
22.	4/02	0255	109	0339	S16 W44	2	0250	120	G	3			*3000	Tok	CD	0301	0336.5	60.	800	-2.5		
													3750									
23.	4/12	1850	80	1920	S25 W73	2(2+)	1856	89	S	3+	1904.7	(1856)	*2800	Ott	SD	1855.5	1900.5	23	525	-19.5		
											11.3/3											
24.	4/18	1310	43	1323	S16 E14	2	1304	36	S	2+	1304	(1305)	1500	HNI	CD	1305		25	451			
											8/3		2800	Ott	SD	1305	1306.8	7.0	385			
													3000	HNI								
													*2980	Med	CD	1304		6.0	550	M_2		
25.	6/04	0859	41	0902	S17 W27	2	0900	30	S	3-		(0859)	2980	Med	SD	0859		10	350			
													*		SD	0917		11	610	M_2		
															SD	0928		4	66			
26.	6/05	1326	67	1330	S17 W43	2	1328	26	S	3-	1329		*2800	Ott	SD	1327	1328.2	8.0	725	-1.8		
											4/3+		*2980	Med	SD	1325		4.0	> 670			
27.	6/06	1130	18	1133	S14 W27	1	None reported						*2800	Ott		1129	1129.8	1.5	525	-3.2		
													*2980	Med	CD	1129		1.0	1700			
28**	6/19	1609	40	1613	N20 E45	2(2+)	1608	44	S	3	1615	(1609)	*2800	Ott	SA	1609	1610	10.0	2325	-3.0	7	W
											5/3		2980	Med								
29**	6/22	0236	21	0241	N23 E12	2	0229	74	S	2		(0231)	2000	Mag	CD	0233		8.0	92			
													*3000	Tok	CD	0231	0238.4	21.3	570	-2.6	8	5.0
30.	6/27	2322	56	2335	N20 W62	1	2325	55	SL	1		(2408)	1420	Syd	CD	2357		8.2	> 239			
		2330	57	2335	N14 E32	1+							*3000	Tok	CD	2408	2541.5	25.0	504	M_1		
													3750	Mag	CD	2411	2540	16.0	42			
31.	7/02	No flare reported					0013	47	SL	2		(0015)	2000	Mag	ESD	0016	0016.3	2.5	70			
													2800	Ott	SD	0015	0017	6.0	180			
													*3000	Tok	CD	0015	0016.5	23.0	> 630	F		
													3750	Mag	SD	0015	0016.3	3.9	305			
32.	7/21	0633	87	0658	N30 E15	2	0647	60	S	3			*2980	Med	SD	0659.5	--	7.0	536	M_2		
													3750	Mag	ECD	0633	0633.5	1.5	106			
33.	7/21	1320	82	1337	N29 E12	2(3)	1335	45	S	2+		(1321)	2800	Ott	CA	1321.5	1322.5	6.5	23			
													*		SD	1334.5	1335.9	8.0	850	- 1.1		
34.	8/10	0125	17	0129	N26 W71	1	0100	60	SL	3	0129.4		1420	Syd	ESD	0128	--	2.5	> 196			
											44/3		2000	Mag	SD	0127	0128.6	3.0	550			
													3000	Tok	CD	0126.7	0127.5	2.5	1400			
													*3750	Mag	ECD	0126	0127.4	4.0	1700	- 3.0		

* Used in the Analysis

** With PCA Association

*** Only values of Δt used in the Analysis are recorded in this column.

M_1 Time of flare maximum unknown

M_2 Time of RF peak unknown

N See the note indicated by the subscript.

TABLE I (Continued)

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s								PCA	
		Start	Duration Min.	Time Max.	Position	Imp.	On-set	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration Min.	Peak Int.	Δt	No.	Int.
35**	8/28	2010	235	2024	S29 E30	2+(3)	2020	18	S	2+	2021.9 4.1/3		*2800	Ott	SD	2017.7	2019.5	5.0	760	- 4.5	13	3.2
36.	8/30	No flare patrol					2215	25	SL	2	2213.7 33/3	2212 31/3	*2000	Mag	ECD	2210	2213.7	6.0	619			
													2800	Ott	SD	2210	2213.7	10.3	480	P		
													*3750	Mag	ECD	2209	2213.1	8.0	538			
37.	8/31	0521	104	0552	S31 W02	2+(3)	None reported					(0548)	1420	Syd	SD	0548	0549	2.0	214			
		*0544	42	0550	N13 E03	2	0544	76	S	3			2000	Mag	ECD-CA	0548	0549	80.0	164			
													2980	Med	CD	0548	--	12.0	426			
													*3000	Tok	CD	0545.5	0549	>3.5	569	-1		
													3750	Mag	CD	0548	0448	60.0	261			
38.	9/01	0946	43	0952	N12 W09	2 (3)	0950	40	S	2			*2980	Med	CD	0949	--	7.0	605			
													3000	Tok	SD	0949	0950	3.0	332	-2		
39.	9/03	1018	45	1023	N15 W40	2(2+)	1020	42	S	2+			1500	HHI	CD	1022	1026	28.0	274			
													*2980	Med	CD	1021.5	--	13.0	738	M_2		
															SD	1039	--	2.0	424			
													3000	Gor	ECD	1027	1027	2.0	268			
40.	9/07	0810	35	0823	N15 W88	1+ (2)	0806	36	S	3			*1500	HHI	SD	0811	0812	43.0	571			
													*2000	Mag	ESD	0811	0813	4.5	800			
													*2980	Med	SD	0811.5	--	9.0	≈2220			
													3000	HHI								
													*3750	Mag	ESD	0811	0812.8	3.0	2015	-10.2		
41.	9/12	No flare patrol 0200 to 0300 UT					0202	57	G	2			1420	Syd	SD	0221	0221	0.6	127			
													*3000	Tok	CD	0220.5	0221.3	2.0	610	P		
													3750	Mag	CD	0219	0221.4	2.5	102			
42.	9/12	1510	88	1516	N11 W18	2 (3)	1513	39	S	2+	1516 72/3+	1515 310/3	*1500	HHI	CD	1515	1516	28.5	627			
													*2800	Ott	SD	1514	1515	18.0	850	-1		
													*2980	Med	CD	1515	--	11.0	1220			
													3000	HHI	CD	1514	1516	16.0	--			
43.	9/13	0602	122	0623	S10 W24	1 (2)	0603	24	SL	1			1420	Syd	SD	0623	0623	2.5	224			
													2000	Mag	ECD	0622	0622.4	3.0	290			
													*2980	Med	CD	0622	0622	1.0	618	-1		
													3000	Gor	ECD	0623	0623	3.0	380			
													3750	Mag	ECD	0622	0622.4	3.0	204			
44.	9/15	0333	45	0337	N07 E69	2	0327	83	S	3			2000	Mag	SD	0332	0335	5.0	111			
													*3000	Tok	SD	0332.5	0334	7.0	830	-3		
													3750	Mag	SD	0332	0334	5.0	460			
45.	9/20	0529	23	0533	N23 W13	1	0532	10	S	1			2000	Mag	CD	0537	0539	8.0	23			
													*3000	Tok	CD	0537	0539	11.0	509	+6		
													3750	Mag	SD	0536	0539	6.0	200			
46.	10/08	0231	27	0240	N17 W05	2	0230	24	SL	2-			1420	Syd	SD	0232	0234	3.0	186			
													2000	Mag	SD	0232.5	0234.2	3.0	217			
													*3000	Tok	ESD	0233.5	0234	7.5	800	-6.0		
47.	10/15	No flare patrol 2000 to 2400 UT					2150	12	S	1+			1420	Syd	SD	2152	2153	3.5	421			
													*2800	Ott	SD	2150	2153	10.0	1000	P		
48.	10/18	0816	119	0828	S24 W04	1 (2)	0820	20	S	3			1500	HHI	CD	0816	0820	9.0	184			
													*2980	Med	SD	0818	--	12.0	544	M_2		
													3000	HHI		0810	0821	46.0	238			
49.	10/19	0406	9	0410	S28 W20	1	0406	24	S	1			2000	Mag	SD	0403	0405.7	7.0	135			
													*3000	Tok	ESD	0405	0406	7.0	700	-4		
															SD	0431	0431	7.2	370			
																0441	0445	8.5	369			
													3750	Mag	CD	0400	0405	8.0	160			
50.	10/20	No flare patrol 0000 to 0310 UT					0242	38	S	2+			1420	Syd	F	0251	0255	8.0	252			
													2000	Mag	F	0248	0255	10.0	339	P		
													*3000	Tok	CA	0239	0254	40.0	1100			
													3750	Mag	F	0238	0254.4	18.0	478			
51.	10/23	0621	24	--	S27 W76	1+ (3)	0620	32	S	2			2000	Mag	ESD	0622.5	0623.6	4.5	405			
													*3750	Mag	ECD	0622.4	0623.4	5.5	1640	M_1		
52.	10/26	No flare patrol 0000 to 0400 UT					0135	20	S	2			1420	Syd	CD	0139	0139	6.0	99			
													2000	Mag	CD	0138	0139	8.0	125	P		
													*3000	Tok	CD	0138	0139	10.0	880			
													*3750	Mag	F	0138	0138.2	1.0	1440			
53.	10/30	No flare patrol 0000 to 0220 UT					None reported						2000	Mag	CD	0038	0040	9.0	64			
													*3000	Tok	CD	0037	0040	16.0	550	P		
													3750	Mag	CD	0038	0040	9.0	78			
54.	11/05	1205	52	1207	S24 W54	2 (3)	1207	14	S	2+			1500	HHI	CD	1204	1208	17.0	247			
													* 2800	Ott	SD	1205	1207	8.0	550	0		
													2980	Med								
													3000	HHI								
55.	11/06	0834	26	0841	S28 W67	2 (2+)	0833	29	S	3-			*2980	Med	SD	0837	--	3.0	572	M_2		
													3000	Gor								
56.	11/15	0517	79	0537	N18 W45	1+ (3)	0527	51	G	1-			1420	Syd	SD	0542	0543	6.5	165			
													2000	Mag	CD	0526	0542	25.0	138			
													*3000	Tok	CA	0522	0542	>38.0	537	+5		
													3750	Mag	CD	0522	0542	30.0	93			
57.	11/22	0404	42	0409	N31 W28	2 (2+)	0406	33	S	3-			1420	Syd	CD	0407	0409	2.5	184			
													2000	Mag	ECD	0406	0409.4	9.0	200			
													*3000	Tok	CD	0406	0409	30.0	870	0		
													3750	Mag	ECD	0406	0409.7	10.0	>380			
58.	11/23	0750	95	0802	N26 W54	2 (3)	0757	40	S	2			1500	HHI	CD	<0759	0759	>7.0	179			
													*2980	Med	CD	0754	0759	14.0	560	-3		
													3000	HHI	CD	0750	0759	63.0	--			
59.	12/06	2400	30	--	S22 W45	1+	2347	23	SL	1+			2000	Mag	SD	2346	2348.5	5.0	174	M_1		
													*3000	Tok	SD	2346	2348	9.0	810			
													*		ESD	2400.2	2400.2	0.9	740			
													3750	Mag		2346	2348.4	3.0	290			
60.	12/13	< 0227	> 79	0234	N15 E90	1	0156	49	SL	3			1420	Syd	SD	0159	0200	4.0	165			
													2000	Mag	CA	0159	0233	43.0	211			
													*3000	Tok	CA	0153	0232	70.0	1130	-2		
													*3750	Mag	CA	0155	0232	46.0	650			

TABLE I (Continued)

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s							PCA	
		Start	Duration Min.	Time Max.	Position	Imp.	Onset	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration Min.	Peak Int.	Δ t	No.	Int.
61.	12/17	0734	150	0737	N20 E41	2+	0732	58	SL	2+			*1420	Syd	CD	0736	0741	15.0	626	+4	S10	Weak
62.	12/19	0915	60	--	N21 E16	1	None reported						1500	HHI	CD	0916	0933	31.0	243	M_1		
													*2980	Ned	CD	0917	--	21.0	632			
63.	12/21	2334	26	2345	S15 E60	1-	None reported						2000	Mag	SD	2346	2347	3.0	41			
		2344	18	2347	N25 E27	1-							*3000	Tok	CD	2345	2346.3	5.0	556			
		2349	36	2418	N17 W27	1-							3750	Mag	SD	2346	2347	2.0	180	N_2		
64.	12/22	0437	28	0442	N18 W26	1-	None reported						1420	Syd	CD	0439	0439	1.0	479			
		0438	5	0439	S21 E16	1-							2000	Mag	CD	0437	0439	5.0	93	N_3		
		0438	7	0440	S20 W35	1-							*3000	Tok	CD	0437	0439	7.0	505			
		0439	25	0443	S26 E41	1-																
65.	12/22	1022	39	1034	N19 W28	1+	1030	22	S	3			2980	Ned	CD	1028	1031	6.5	583	-3		
66.	12/22	2240	52	2244	N20 W34	1 (2)	2238	52	S	2+		(2235)	1420	Syd	CD	2236	2240	> 6.0	>952	-4		
67.	12/23	< 0025	215	0029	N18 W38	1	0022	43	SL	1+			2000	Mag	SD	0038	0038.5	1.0	14			
		0038	14	0039	N26 E40	2							*3000	Tok	ESD	0024.5	0025.5	4.0	582	M_4		
															ESD	0038	0038.5	2.0	564			
													3750	Mag	SD	0024.5	0025.5	2.0	123			
															SD	0038	0038.4	2.0	90			
68.	12/23	1436	81	1440	N18 W45	1+	1438	24	SL	2+		1437 43/3	2800	Ott	CA	1437	1447	23.0	155			
													*2980	Ned	CD	1441	--	10.0	602	M_2		
69.	12/24	0003		--	N30 E30	1	None reported						*3000	Tok	CD	0018	0020	7.0	511	M_1		
															SD	0103	0103.7	1.0	527			
															CD	0127	0127.7	3.0	503			
70.	12/24	0221	13	0227	N21 E03	1	None reported						*3000	Tok	SD	0222	0222.5	1.0	570	-4.5		
															CD	0227.5	0229.5	2.5	512			
71.	12/25	0435	> 2	--	S07 W59	1	0430	25	S	2+			1420	Syd	CD	0436	0437	4.5	356	M_1		
													2000	Mag	SD	0434	0437.2	6.0	94			
													*3000	Tok	SD	0434	0437	16.0	800			
															CD	0455	0459.7	5.0	472			
72.	12/25	No flare reported					None reported						2000	Mag	SD	0530	0530.3	1.0	22	F		
													*3000	Tok	CD	0529.9	0530.2	5.0	524			
													3750	Mag								
73.	12/26	No flare patrol					0245	40	S	2+			*2000	Mag	ESD	0245.5	0246.5	2.5	1690			
													*3000	Tok	ECD	0245	0246	15.0	2300	P		
													*3750	Mag	ECD	0245.5	0246.3	5.0	2650			
74.	12/28	2229	62	2230	N25 W50	2	2230	30	S	2+			*1420	Syd	SD	2230	2230	7.0	916	0	S11	Weak
	1958																					
75.	1/15	1640	77	1642	S13 W58	2+ (3)	1640	120	S	3		(1640)	2800	Ott	SD	1640	1720	240.0	40			
													*		SA	1640	1642.7	28.0	1350	+0.7		
76**	2/09	2108	114	2142	S12 W14	2+	2124	20	SL	1		2116 106/3	1420	Syd	CA	2113	2136	24.5	207			
															CA	2138	2152	32.0	856	+10	22	3.2
77.	2/26	0527	65	0550	S18 W61	2	0540	56	SL	2+	0602 9.5/2	(0551)	1420	Syd	SD	0551	0552	8.0	168			
													2000	Mag	CD	0543	0551.7	12.0	175			
													3000	Tok	CD	0543	0545.8	5.0	343			
													*		ECD	0550	0550	8.0	1048	0		
													*3750	Mag	CD	0543	0551.7	14.0	500			
78.	3/02	No flare patrol 1100-1300 UT					1136	21	S	1			*2980	Ned	CD	1134	--	6.5	941			
													*3000	Tok	SD	1132	1138	16.0	736	P		
79.	3/28	1030	82	1038	S24 E26	2	1034	41	S	3+			1500	HHI	SD	1034	1035	5.0	179			
													2980	Ned								
													*3000	Tok	SD	1033	1034	15.0	758	-4		
80.	3/28	1703	121	1714	S15 E09	2+	1708	70	S	3		(1702)	*2800	Ott	SD	1708.5	1711.5	14.0	575	-7.5		
81.	3/28	2042	49	2047	S24 E21	2	2042	26	S	2+			*2800	Ott	CD	2043	2045.1	33.0	520	-1.9		
82.	3/29	1339	31	1343	N55 E78	2	1340	35	S	3			1500	HHI	SD	1340	1342	10.0	186			
													2800	Ott	SD	1340.5	1342	10.0	310			
													*2980	Ned	SD	1341.5	--	1.5	624	-1		
													3000	HHI								
83.	3/29	1819	56	1823	S24 E08	2	1821	59	S	3			2800	Ott	SD	1820.5	1821.8	12.5	1400	-1.2		
84.	3/30	0045	38	0108	W35 E74	2	0109	12	S	2			2000	Mag	F	0052	0052.3	1.0	23			
															ESD	0107	0107.6	2.0	180			
													*3000	Tok	CD	0106.5	0107.7	5.0	735	-0.3		
													3750	Mag	ESD	0107	0107.6	1.0	361			
85.	3/31	0005		0014	S17 W22	2	0006	44	G	2+			2000	Mag	CD	0007	0010.3	7.0	86		S14	
													*3000	Tok	CD	0006	0010.3	9.0	561	-3.7		
													3750	Mag	CD	0006	0010.3	7.0	188			
86.	4/01	1050	120	1100	S13 W43	2+	1055	38	S	2+			*1500	HHI	CD	1052	1055.5	69.0	838	-4.5		
													2800	Ott	SD	< 1053	1054.5	> 7.0	474			
													2980	Ned		1053.5						
87.	4/02	< 0502	> 13	--	S23 W34	2	0459	74	S	2+			2000	Mag			0500.5					
													*3750	Mag	SD	0458	0500.3	3.5	840	M_1		
88.	5/05	2025	50	2035	N24 W50	1+							*2800	Ott	CA	2034.7	2036.5	7.0	580	-0.5		
		*2032	43	2037	S15 W39	1+	2032	38	S	2+												
89.	6/04	0055	14	0103	N47 E74	1	None reported						1420	Syd	F	0042	0043	12.0	236			
													2000	Mag	F	0045	0045.6	3.0	260			
															CD	0050	0052.2	8.0	130			
													*3000	Tok	CD	0045.4	0047.0	4.0	>674	-16.0		
															ECD	0050	0053	13.0	470			
													3750	Mag	SD	0034	0035.5	3.0	62			
															F	0045	0047.2	3.0	400			
																0051	0053	7.0	155			
90.	6/05	0835	90	0850	N15 W65	2+	0842	55	S	2+		(0839)	1500	HHI	SD	0833	0841.5	37.0	451			
													2980	Ned								
													*3000	HHI	SD	0839.5	0843.4	25.5	868	-6.6		
													3000	Jod	ESD	0840	0844	10.0	403			
													3000	Gor								
91.	6/05	1615	142	1631	S18 E69	2+	1620	100	S	3			1500	HHI	CD	1616	1623.5	84.0				
																	1713.5					
																	1715.5					
																	1720.3					
																	1723.4		625	N_5		
													2800	Ott	SD	1614	--	180.0	25			
																1614	1623	18.0	387			
																1655	1710	23.0	360			
																1718	1723.5	22.0	255			
													3000	HHI	SD	1617	1622.7		586			

TABLE I (Continued)

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s								PCA	
		Start	Duration	Time	Position	Imp.	On-set	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration	Peak Int.	Δt	No.	Int.
92.	6/26	0245	152	0306	N10 E49	2+ (3)	0247	85	SL	2+	0304 16/-	(0255) 0319 116/1	2000	Mag	CD	0244	0245.9	4.0	34			
													3000	Tok	CD	0243	0245	7.0	410			
													3750	Mag	CD	0244	0244.9	3.0	57			
													1420	Syd	CD	0255	0316	30.0	189			
													2000	Mag	CD	0255	0316.2	30.0	100			
													*3000	Tok	CD	0255	0307.8	22.0	507	M_6		
													3750	Mag	CD	0255	0307.8	30.0	155			
93.	6/27	0254	71	0308	N10 E37	1+ (2)	0308	25	S	2			2000	Mag	SD	0306	0306.8	3.0	70			
													*3000	Tok	ESD	0306	0306.5	6.0	593	- 1.5		
													3750	Mag	SD	0305	0306.7	7.0	245			
94.	7/03	0041	33	0050	N30 E37	1+ (2)	0050	7	S	1-			1420	Syd	SD	0048	0048	2.0	206			
													2000	Mag	SD	0046	0048.2	3.0	125			
													*3000	Tok	SD	0045	0048.2	6.0	620	- 1.8		
													3750	Mag	SD	< 0048.1	0048.1	>1.0	310			
95.	7/04	0513	21	0517	N29 E26	1+	0517	11	S	1			1420	Syd								
													2000	Mag								
													2980	Med								
													*3000	Tok	CD	0516	0517	4.0	>789			
													*3750	Mag	ESD	0515	0517.1	2.5	800	+0.1		
96.	7/20	No flare reported					0244	31	S	1			2000	Mag	SD	0241	0242.6	2.5	115			
													*3000	Tok	ESD	0241.0	0242.5	4.0	597	F		
													3750	Mag	SD	0241	0242.5	2.5	230			
97.	7/24	2327	121	2443	N10 E85	2+	2444	56	C	2			2000	Mag	SD	2440	2443.2	6.0	(75)			
													*3000	Tok	ESD	2441.3	2443	7.0	828			
													*3750	Mag	SD	2441	2443.1	4.0	535	+0.1		
98.	7/29	0458	28	0458	S14 W38	1	None reported						2000	Mag	CD	0503	0510	40.0	(31)			
													*3000	Tok	CD	0505.2	0512	8.0	506	+14		
													3750	Mag	SD	0503	0510	30.0	(10)			
99.	8/02	1840	11	1841	S14 W90	1-	1840	153	S	3+	1843 8/3	(1840)	2800	Ott	SD	1840	--	>300.0	30			
															SA	1840	1842.1	25.0	2050	+1.1		
													2980	Med								
100.	8/20	0042	46	0044	N16 E18	2+ (3)	0042	33	S	2+	0046 5/3 0046 19/-	(0042)	1420	Syd	CD	0040	0044	13.0	255			
													*2000	Mag	ECD	0040	0044	7.0	(620)	M_7	29	3.0
													*3000	Tok	CD	0041	0043.3	7.0	1260			
													*3750	Mag	ECD	0041.5	0042.4	5.0	1450	-1.6		
101.	8/28	1025	20	1030	S18 W64	2+	1023	62	S	3		(1028)	1500	HHI	CD	1009	1039	53.5	215			
													2800	Ott		1028	1039.5	20.0	350	M_8		
													* 3000	HHI	CD	1019	1039	36.0	573	+9.0		
													HHI also max. at 1028 and 1030									
													OTT in sunrise oscillation									
102.	9/14	0822	128	0835	S10 W80	2+ (3+)	0851	58	S	3		(0832)	1500	HHI	CD	0834	0904	85.0	460			
													2980	Med	SD	0833.5	--	5.0	371	M_9		
													*		CD	0847.5	--	43.0	870			
													*3000	HHI	M	0830	0904	69.0	1259	+29		
103.	10/19	0634	106	0725	S17 W35	2+ (3)	0720	30	S	2			1420	Syd								
													2000	Mag	ESD	0723	0725	3.0	305			
													2980	Med								
													*3750	Mag	ESD	0723	0723.9	2.0	585	-1.1		
104.	10/21	2318	129	2330	S04 W22	2+ (3)	2328	72	S	3+	2328 13/3+ 2328 32/-	2327 23/3 2344 16/3	2000	Mag	CD	2323	2327	55.0	428			
													*				2355		520			
													*3000	Tok	CD	< 2345	2345	>35.0	1900			
													*3750	Mag	CD	2323	2327	55.0	1150	-3.0		
105.	11/21	No flare patrol 2230-2430					None reported						*1420	Syd	CD	2318	2320	3.0	532			
													2000	Mag	CD	2316	2319.1	5.0	(165)	F		
													3750	Mag	F	2318	2320.4	3.0	(25)			
106.	12/11	1116	37	1127	S01 E03	2	1122	22	S	2			*1500	HHI	CD	1111	1129	24.0	683	+2.0		
													2980	Med	CD	1115	--	20.0	358			
													3000	HHI								
107.	12/11	1802	40	1812	S02 W06	2	1808	32	S	2+		(1805)	*2800	Ott	SD	1805	1810	20.0	1225	-2.0		
108.	12/12	1215	212	1304	S03 W08	2+	1257	38	S	2		(1258)	1500	HHI	SD	1251.5	1252.8	2.5	191			
													2800	Ott	SD	1252	1252.8	1.0	35			
													*		SD	1257	1300.5	18.0	1500	-3.5		
													*2980	Med	CD	1258	--	18.0	~1799			
109.	12/17	1047	28	1053	S16 W57	1	None reported						1500	HHI	SD	1039	1041	19.0	420	-12.0		
													*2980	Med	SD	1039.5	--	5.0	571			
110.	12/23	0543	138	0624	S15 E66	2+ (3)	0540	73	C	3+		(0559)	1420	Syd	F	0559	0605	11.0	165			
													2000	Mag	CD	0534	0605	65.0	370	-19.0		
													*3000	Tok	CD	0536	0605	>50.0	1750			
													*3750	Mag	CD	0534	0605	50.0	1020			
111.	12/24	0946	24	0950	S14 E54	1 (1+)	0943	17	S	1			1500	HHI	SD	0946	0947	6.5	260			
													*2980	Med	SD	0946	--	3.0	493			
													3000	HHI	SD	0946	0947	10.5	470	-3.0		
														Jod	ECD	0950	0951	2.0	330			
	1959																					
112.	1/14	2140	12	2142	N21 E11	1-	None reported						*2800	Ott	--	2130	--	15.0	2000	M_2		
113.	2/08	1342	94	1410	N26 W69	1 (1+)	1342	29	S	2	1344.5 5.3/3	(1342)	*1500	HHI	CD	1342	1348	7.0	645	-22		
													2800	Ott	CD	1342.5	1343	8.0	(180)			
													2980	Med								
													3000	HHI	CD	1340.5	1343.2	11.1	455			
114.	3/02	2317	33	2320	N25 W56	1+	2320	39	S	2			2000	Mag	SD	2317.5	2319.7	6.0	97			
													*3750	Mag	SD	2317.5	2319.4	4.0	640	-0.6		

TABLE I (Continued)

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s								PCA	
		Start	Duration Min.	Time Max.	Position	Imp.	Onset	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration Min.	Peak Int.	Δ t	No.	Int.
115.	3/21	1256	65	1331	N28 W46	1+ (2)	1325	33	SL	1			1500	HHI	SD	1329.7	1330	1.3	141			
													*2980	Med	SD	1329	1330	1.0	~502	-1		
116.	3/29	0746	104	0754	N17 E36	2	0750	40	S	3		(0746)	2000	Mag	CD	0747	0751	9.0	500			
													2980	Med	SD	0747	--	19.0	>588			
													*3750	Mag	SD	0746	0750	10.0	1050	-4		
117.	4/07	1520	20	--	N24 E51	1	None reported						*1500	HHI	M	1522	1524	27.7	822	M_1		
													3000	HHI	CD	1522.8	1525	4.7	241			
118.	5/08	2252	30	2257	N23 E86	2+ (3)	2258	22	S	2	2259	(2254)	*2000	Mag	SD	2255	2256.5	12.0	1600			
											20/3		*2800	Ott	CD	2254	2257	48.0	2200			
													*3750	Mag	CD	2254	2256.5	10.0	2750	-0.5		
119.	5/13	0457	56	0514	N22 E26	2+	0511	36	S	2	0516	0525	2000	Mag	CD	0510	0513.2	6.0	230			
											9/-	65/-	*3750	Mag	SD	0510	0513.1	5.0	570	-0.9		
120.	5/13	2339	38	2342	S09 E88	1+ (2)	2340	10	S	1+			2000	Mag	SD	2340	2340.8	2.0	640			
													2800	Ott	ESD	2340.3	2341	>2.7	880			
													3000	Tok	ESD	2341.0	2340	>2.0	440			
													*3750	Mag	SD	2340	2340.6	1.5	1000	-1.4		
121.	5/17	0523	37	0527	N21 W30	2+ (3)	0525	35	S	2+		(0523)	*2000	Mag	CD	0524	0525	15.0	2700			
													3000	Tok	ECD	0524	0525	20.0	466	-2.0		
													*3750	Mag	CD	0523	0525	13.0	3300			
122.	5/17	0700	28	0707	N21 W30	1 (2)	0705	23	S	2+			*1500	HHI	F	0706	0707	29.5	922			
													*2000	Mag	SD	0705.5	0706.8	4.0	815			
													*3000	HHI	CD	0705	0707	23.1	1277			
													*3750	Mag	SD	0705	0706.7	3.0	1280	-0.3		
123.	5/18	No flare patrol 0150 to 0430					0404	50	S	2	0407		*2000	Mag	SD	0403	0404.3	5.0	930			
											5/-		3000	Tok	ESD	0403.2	0404.0	11.0	440	P		
													*3750	Mag	SD	0403	0404.2	3.0	1750			
124.	6/09	No flare reported					1635	180	S	3+		1714	1500	HHI	CD	1644	~1656	103.5	>1130			
												46/2	2800	Ott	SD	1635	1652	412.0	2000	F		
													2980	Med	CD	1640	--	27.0	>759			
125.	6/09	1707	113	--	N17 E90	2	None reported					1714	2800	Ott		1707.5	1709.5	5.0	15			
												46/2			CA	1716	1719	12.0	135	M_1		
													*		SA	1728	1740	70.0	1800			
													*2980	Med	CD	1735	--	45.0	>750			
126.	6/10	No flare reported					None reported				0247		*2000	Mag	SD	0244.5	0246.6	5.5	1450			
											21/-		*3000	Tok	ESD	0245.8	0248	8.0	520	F		
													*3750	Mag		0245	0247		2250			
127.	6/13	0357	11	0358	N17 E58	1 (1+)	0358	20	S	1			2000	Mag	SD	0357.5	0358.3	3.5	450		S	17 1.5
													3000	Tok	ECD	0358	0359	8.0	480			
													*3750	Mag	SD	0357	0358.2	2.5	530	+0.2		
128.	7/27	1222	78	1230	N14 E50	2 (2+)	1228	26	S	2+			1500	HHI	CA	1225	1229	45.0	570			
													2800	Ott	SD	1225	1229	76.0	1025	-1.0		
													3000	HHI		1218	1234.5	14.0	>400			
													2980	Med								
129.	7/29	1202	126	1213	N11 E27	2	1158	102	SL	2+			2800	Ott	SD	1158	1209	290.0	325			
													*2980	Med	CD	1202	--	13.0	497	M_2		
													3000	HHI								
130.	7/29	2117	86	2120	N15 E22	2+	2120	45	S	2		(2117)	*2800	Ott	SD	2118	2119	65.0	790	-1.0		
131.	8/17	1218	30	1230	N15 W20	1+, (2)	1220	22	S	2+			2800	Ott	SD	1219	1221	67.0	335	-9.0		
													2980	Med	SD	1219	--	5.0	560			
													*3000	HHI	F	1218.7	1221	5.8	681			
132.	8/28	0027	61	0039	N11 E71	1, (2)	0028	140	SL	2+	0038	0055	2000	Mag	CD	0029	0043	25.0	250			
											10/2	155/-	3750	Mag	CD	0024	0041	30.0	540	+2.0		
133.	8/28	0111	12	0113	N13 E69	1	None reported						1420	Syd								
													*2000	Mag	CD	0111	0123	30.0	2250	+10.0		
													*3000	Tok	ESD	0115	0120	20.0	1520			
													*3750	Mag			0118		890			
134.	9/03	0421	18	0423	N25 E86	2+	0422	20	S	3	0424.5		1420	Syd	ESD	0420	0421	5.5	173			
											13.5/-		2000	Mag	SD	0421	0422.2	3.5	385			
													*3000	Tok	ESD	0420.5	0420.5	2.0	6850	-2.5		
135.	10/17	No flare reported					None reported						3000	Tok	ESD	0150.8	0150.9	2.0	543	F		
136.	10/17	No flare reported					None reported						3000	Tok	ESD	0222	0222.2	1.0	600	F		
137.	10/20	No flare reported					None reported						3000	Tok	ESD	0012.5	0012.8	3.0	717	F		
138.	11/26	0923	153	0937	S15 W17	2+	0930	46	S	1+			2980	Med	CD	0928	--	14.0	530	M_2		
139.	11/30	0247	69	0250	N08 E16	2+	0249	31	S	3-	0251	0312	*2000	Mag	CD	0247	0250.3	18.0	2750			
											67/-	38/-	*3000	Tok	CD	0248	0252.5	9.0	1229			
													*3750	Mag	CD	0247	0252.3	12.0	1750	+2.3		
140.	12/02	1219	113	1229	N07 W16	2+	1246	76	S	2+		(1250)	*2800	Ott	SD	1245	1248	12.0	875	+19		
													2980	Med	CD	1246	--	9.0	543			
141.	12/05	1215	35	1221	N12 W07	2	1220	12	S	2			2980	Med	SD	1216	--	1.0				
													*		CD	1219	--	2.0	551	M_2		
															SD	1224	--	1.0	367			
142.	12/08	0747	52	0756	N12 W43	2	0755	25	S	1+			*2980	Med	CD	0757	--	4.0	560	M_2		
143.	12/21	0043	187	0052	S04 W54	2	None reported				0055	0120	*3000	Tok	CD	0045	0050	12.0	611	-2.0		
											25/-	150/-										
	1960																					
144.	1/15	1336	79	--	S20 W68	2 (3)	1340	45	SL	1+		(1336)	1500	HHI	C+	1335	1410	>85.0	440			
													*3000	HHI	C+	1334	1357.6	87.0	750	M1		
145.	2/18	No flare reported					0103	111	S	3+			*3750	Mag	C	0053	0101.3	17.0	765	F		
146.	3/28	2042	68	2056	N15 E37	2	2050	50	S	2+	2057	2050	*2800	Ott	C+	2047.7	2055	14.8	750			
											15/3	>240/3				2102.5	2117	55.2	885	M_{10}		
147**	3/29	0640	320	0710	N13 E30	2+ (3)	0652	121	S	3+		(0656)	*2000	Mag	C+	0655	0733.4	120.0	49000		39	2.6
													*3750	Mag	C+	0655	0733.5	52.0	8250	+23.5		

TABLE I (Continued)

	DATE	ASSOCIATED SOLAR FLARE					SHORT WAVE FADE				SPECTRAL		SINGLE FREQUENCY 1500 TO 3750 Mc/s							PCA	
		Start	Duration Min.	Time	Position	Imp.	On-set	Dur. Min.	Type	Imp.	Start/Dur/Imp II	IV	f	Obs.	Type	Onset	Time Max.	Duration Min.	Peak Int.	Δt	No.	Int.
148**	3/30	1455	339	1540	N12 E13	2 (3+)	1520	160	SL	3	1529 11/3	1526 454/3	*2800	Ott	C+	1518	1527 1556	22.0 198.0	640 1750	+16	40	5.0
149.	4/03	< 0317	5	0317	N12 W33	2	0305	25	S	2+			2000 *3750	Mag Mag	 C	0306 0306	0310.5 0310.6	5.0 5.0	400 1300	- 6.4		
150.	4/05	< 0215			N12 W62		0140	157	SL	3+	0152 15/3	0207 53/3	*2000 *3000 *3750	Mag Tok Mag	C+ CA C+	0140 0152 0140	0206.1 0202.7 0202.3	125.0 64.0 90.0	1230 2400 6000	F	42	3.1
151.	4/29	No flare reported					None reported						*2000 3750	Mag Mag	C S	0525 0526	0538.1 0532.0	23.0 24.0	990 115	F		
152.	5/26	0850	120	0928	N14 W15	2+	0914	46	S	2		(0909)	*2980	Ned	C+	0909	--	27.0	1350	M_2		
153.	6/25	< 1026	> 20	1029	N19 E03	1+ (2)	1027	33	S	2			1500 *2800 3000	HHI Ott HHI	s S	1025.8 1026	1027.1 1026.9	10.5 5.0	193 650	- 2.1		
154.	6/25	2039	61	2046	N19 W04	2+ (3)	2040	30	S	2-	2048 17/3	2045 68/3	*2800	Ott	C+	2037	2046	40.0	700	0		
155.	6/29	0125	82	0148	N21 W50	1 (1+)	0138	128	S	2			2000 *3750	Mag Mag	F F	0137 0135	0142.3 0147.9	17.0 21.0	240 840	-0.1		
156.	6/30	1029	76	--	N18 W64	1 (1+)	1030	92	S	2-			*1500 2980 3000	HHI Ned HHI	C S	1019.5 1025	1037.1 --	52.5 23.0	541 366	M_1		
157.	8/07	0724	41	0737	N18 E84	1	0730	55	S	2+			1500 2000 *3750	HHI Mag Mag	C C C	0723.5 0725 0725	0730.2 0730.0 0729.3	50.5 10.0 20.0	284 450 610	- 7.7		
158.	8/11	0223	97	0257	N21 E35	2 (2+)	0225	90	SL	2			1420 2000 *3000 *3750	Syd Mag Tok Mag	 F CD F	 0223 0235.6 0222	 0253.0 0252.0 0252.9	 35.0 19.0 35.0	 375 562 610	 - 4.1		
159.	8/11	1916	99	1929	N22 E26	2+ (3+)	1925	65	S	2	1929 9/3+	1926 53/2	2800 *	Ott	s S	0916 0923.5	 0928	144.0 37.0	9 1100	 - 1.0		
160.	8/14	0511	104	0525	N22 W06	2+ (3)	0515	45	S	3			*2000 *3750	Mag Mag	C C	0515 0514	0518.2 0518.4	20.0 19.0	775 1410	- 6.6		
161.	8/14	1242	92	1310	N20 E36	2 (2+)	1307	53	S	3-			2800	Ott	S	1307	1310.7	16.0	680	+ 0.7		
162**	9/03	0037	77	0108	N18 E88	2+ (3)	0045	126	SL	3+	0102 22/1	0038 > 16/2	*2000 *3000 *3750	Mag Tok Mag	C C+ C	0035 0059 0039	0105.2 0105 0104.6	90.0 50.0 85.0	7100 5800 12000	-3.4	48 M_{11}	2.7
163.	9/16	1710	105	1724	S22 E68	1	1709	101	S	3	1714 14/3	1717 114/3	*2800 * 2980	Ott Ned	C+ C+	1702 1725	1712 1756	23.0 74.0	550 2000	M_{12}		
164**	9/26	0525	51	0539	S22 W64	1+ (2+)	0520	121	SL	3+	0543 21/2	< 0554 > 17/1	1420 2000 3000 3750	Syd Mag Tok Mag	C C	0529 0532	-- 0545	38.0 28.0	> 139 1120	+6.0	S20	2.0
165.	10/10	0710	86	0722	S17 W23	1+ (2)	None reported						1420 2000 *3750	Syd Mag Mag	C C C	0704 0708 0708	0718 0719.3 0719.2	21.0 20.0 20.0	30 270 510	- 2.8		
166.	10/11	0517	159	0535 0600	S17 W36	2	0525	63	S	3	0530 17/3	0532 > 40/2	1420 2000 3750	Syd Mag Mag	 C+ C+	 0523 0520	 0527.6 0532.8 0528.6	 26.0 40.0	 630 1580	 - 2.2		
167**	11/11	0305	83	0340	N28 E12	2 (2+)	0311	185	S	3+	0349 8/2	0330 219/3	1420 2000 * *3750	Syd Mag Mag	 C+ CS+	 0316 0315	 0320 0427 0317 0345 0430	 120.0 115.0	 46 900 800 3400 1400	 +5.0	G32	VS
168**	11/14	0246	124	0304	N27 W20	2+	0300	120	SL	3		0305 115/3	1420 *2000 *3750	Syd Mag Mag	 FCS FCS	 0258 0258	 0443.7 0354.6	 140.0 140.0	 1800 4300	 +50.6	G:34	VS
	(Gregory associates a proton event on 11/14 at 22xx UT with an importance 1+ at 2114 UT. The importance 2+ flare at 0246 seems to be a more logical candidate.)																					
	1961																					
169.	9/10	1950	64	2010	N08 W80	1	1942	101	SL	3	1947 27/3	1937 50/3	*2800	Ott	C	1930	2001	61.0	880	- 9.0	56 N_{13}	2.9
170.	9/16	1057	121	1110	N18 E77	2+ (3+)	1102	50	S	2			1500 *2980	HHI Ned	C C	1055.0 1101.0	1104.0 1111.6 1104.6	70.0 34.0	 146 532	 - 5.4		
	1962																					
171.	3/13	1444	116	1446	N10 E66	2+	1448	94	S	3			*1500 2000 2800 2980	HHI HHI Ott Ned	C C	1448.7 1447.5	1451.6 1450.3	70.0 19.5	> 880 470	+ 5.6		
	1963																					
172.	1/30	1305	70	1306	N10 W54	1	None reported						1500 2000 2800 2980	HHI HHI Ott Ned	C S	1322.5 1330	1439.5 1355	100.0 450.0	877 11	N_{14}		
173.	5/01	0525	190	0608	N15 E46	2	0530	39	SL	2+			1500 *2000 *3750	HHI Mag Mag	 C+ C+	 0526 0526	 0545 0544	 40.0 34.0	 600 1500	 -24		
174.	9/14	2112	53	2123	N12 E72	1	None reported						2800 *	Ott	Pre C S	2134 2143	 2144.5	9.0 7.0	24 550	 +21.6		
175.	9/14	2202	19	2206	N12 E73	1	None reported						*2000 2800	Mag Ott	C C	2230 2229.5	2235.5 2235	12.0 10.5	1880 180	+29.5		
176.	9/15	0015	124	0042	N15 E75	2	0015	180	S	3+	0027 22/2		2000 3750	Mag Mag	C+ C+	0017 0015	0028 0036.5 0054.4 0028 0036.5 0049.4	110.0 90.0	210 1600 2500 650 4400 8080	N_{15}		
177.	9/16	1430	62	1505	N12 E48	2	1440	125	G	3			1500 2800 2980	HHI Ott Ned	C+ C+	-- 1436.5	1456 1452 1543	240.0 133.5	930.0 318.0 710.0	+38		
178.	9/18	2236	144	--	N12 E20	1	None reported						2000 3750	Mag Mag	C C	2231 2234	2327.0 2330.5	130.0 120.0	1100 57	M_1		
179.	9/20	2314	167	2403	N10 W09	2	2351	214	S	3	2400 76/2 2403 12/3	 2410 > 45/3	2000 3750	Mag Mag	C F C+ C+ C C+	2350 2405 2500 2350 2429 2500	2358.4 2430.4 2517.4 2400.3 2432.7 2515.2	15.0 55.0 55.0 23.0 6.0 45.0	1200 800 2100 1400 330 5350	 N_{16}	58	4.6
180.	10/28	0135	120	0158	N12 W24	3	0140	140	SL	3			2000 3750	Mag Mag	C C	 0139	0156.3 0156.3	40.0 50.0	580 465	-1.7		

TABLE 2

SOLAR FLARES FOLLOWED BY A PCA EVENT

	Date	Flare: Start UT	Flare: Duration Min.	Flare: Max. UT	Flare: Imp.	Flare: Position	Flare: Flare	PCAA: Serial No.	PCAA: Delay	PCAA: Start UT	PCAA: Duration Min.	PCAA: Abs. dB	SWF: Onset	SWF: Dur. Min.	SWF: Imp.	Spectral: II	Spectral: IV	f	Type	Onset	Max.	Duration	Peak Intensity	Energy	Δ t	Notes
	1956																									
1	3/10	< 0515	95	--	2	N16 E88 3831		2	3h 45m	0900	160	3.5	0438	117	3+			3000	CD	0443		80	890			No emissions reported at meter wavelengths.
																		*3750		0447	0518		1000	118	-M_1	
2	11/13	1430	85	1501	2	N16 W10 3753		4	5h 30m	2000	63	5.4	1430	120	2+			1500	BD	1429		>18	256			Also 9400 Mc/s at 1433 UT flux (325).
																		2800	BD	1431	1440	17	175	13	-21	
	1957																									
3	6/19	< 1608	> 41	1613	2(2+)	N20 E84 4024		7	5h 08m	2215		Weak	1608	44	3	1615 5/3	--	2800	BF	1608.8	1610.2	10	2325	34	- 2.8	Also 2980 Mc/s data not given. The 2800 Mc/s burst is superposed on long enduring (130 mins.) rise and fall in flux that started at 1445 UT.
4	6/22	0236	21	0241	2	N23 E12 4024		8	2h 24m	0500	115	5.0	0229	76	2			2000	CD	0233		8	92			Also 9500, Δt = -3, flux = 1470 Sunspot 12417
																		3000	CD	0231	0238	21	570		- 3.0	
5	8/09	0617	63	0629	2	N09 E76 4099		11	9h 43m	1600	50	3.1	0615	35	3-			2000	CD	0623	0625.2	5	51			Also 9375 and 9500.
																		2980	CD	0624	--	4	246			
																		3000	CD	0623	0625	5	190			
																		*3750	BCD	0623	0625.2	4	105		- 3.8	
6	8/28	2010	38	2024	2+(3)	N28 E30 4125		13	3h 50m	2400	27	3.2	2020	18	2+	2022 4/3		2800	BD	2017.7	2019.5	5	760	10	- 4.5	The PCA events 13 and 14, together with Events 12 and 15 (flares 43 and 44, Table 4) see will be considered in some detail when multiple events are discussed.
7	8/29	1031	39	1038	2(3)	N25 E20 4125		14	3h 29m	1300	58	8.2	1039	16	1+			1500	CD	1037	1039	9	151		+ 1	
8	8/28	1257	49	1303	1+(2)	N10 W26 4124		16	4h 03m 3h 47m	1700	46	7.2	1259	>25	0 1			1500	CD	1246	1329	142	304		+26	
																		2800	BD	1247	1330	250	105		+27	
																		2980	CD	1257		45	429			
	9/02	1313	317	1316	2+(3)	S34 W36 4125							1324	43	8 2-			2800	BD	1312.3 1321.3	1319 1324	4 5.5	30 40		+ 3 + 8	
	1958																									
9	2/09	2108	114	2142	2+	S12 W14 4400		22	8h 52m	0600 2/10	37	3.2	2124	20	SL 1		2116 106/3	1420	CA	2113	2136	24.5	207			
																			CA	2138	2152	32.0	896		+10	
																		2800	BD	2105	Indet.	>60.0	70			
10	3/25	0557	29	0603	2	S15 E50 4478		24	9h 33m	1530	122	10.0	0603	27	SL 2	--	--	*3000	BCD	0558.8	0559.3	> 3.0	458		- 3.7	Also 9500 max. intensity 604, Δt = -3.8. No spectral observations at the time of the flare. This flare does not meet any of the requirements for a PCA event. This flare occurred in the same region as the importance 3+ flare responsible for the small PCA (3.5db) No.23 (flare 62, see Table 2). There were 10 importance 1 flares from the region between the Mar. 23 flare and this one.
																		3750	CD	0558.8	0559.3	10.0	108)		- 3.7	
11	6/06	0436	98	0448 0505	2(3)	N16 W78 4578		25	1h 12m	0600		Weak	0436	50	2		0434 36/3	1420	CA	0445	0446	27.0	343			This weak PCA was reported by most of the investigators using f_{min} data. Not reported by Riometers on forward scatter technique.
																		2000	CD	0433	0447.2	26.0	420			
																		*1750	CD	0433	0450.2	28.0	360		+ 2.2	
																		2000	CD	0504.5	0505.7	8.0	73			
																		3750	CD	0505	0505.5	6.0	84			
12	8/20	0042	46	0044	2+(3)	N13 E17 4708		29 37h 18m	1400 8/21		19	3.0	0042	33	2+	0046 19/3	(0042)	1420	CD	0040	0044	13.0	255			Also 9500, peak intensity 3610, Δt = -1.0.
																		2000	BCD	0040	0044	7.0	620		0	This PCA flare is in the same region (4708)
																		3000	CD	0041.2	0043.3	7.0	1260		- 0.7	that produced the two large PCA's (30 and 31) see
																		*3750	BCD	0041.5	0042.4	5.0	1450	15	- 1.6	(flares 72, 73, Table 2) on Aug. 22 and 26, respectively. See RS Table 1
13	7/22	0738	92	0750	2(2+)	S19 W42 4765		32	6h 22m	1400	80	5.0						1500	BD	0737	0745	7.5	207		- 5	Also max. at 0750, only one of the 9 observatories (Trehkamt) reported a time of max. RH intensity.
																		2000	CD	0739	0746	25.0	86		- 4	
																		2980	CD	0739	--	33.0	336			
																		*3000	CD	0733	0745	32.3	314		- 5	Also max. at 0750.
																		3750	CD	0741	0746	20.0	49			
	1959																									
	None																									
	1960																									
14	3/29	0640	346	0710	2+(3)	N13 E30 5615		39	1h 20m	0800	73	2.6	0652	121	3+			2000	C+	0655	0733.4	120.0	40000		+ 23.4	This flare occurred in the large (max. area 1650) F type spot which during disk passage was the source of 7 flares importance ≥ 1 and four PCA events (No. 39, 40 and 42 associated with minor flares, and 41 (Table 2) associated see with the only major flare from this region during disk passage. The Type IV burst that accompanied the flare on 3/30 was observed at Ft. Davis over the frequency range 3900 to 25 Mc/s and by Warwick 31 to 10 Mc/s. This flare appears to have two phases with maxima at 1533 and at 1540 UT.
																		*3750	C+	0655	0733.5	52.0	8250	915	+ 23.5	
15	3/30	1455 1520	335	1533 1540	2(3+)	N12 E13 5615		40	5h 05m	2000	36	5.0	1520	160	3	1529 11/3	1526 271/3	1500 *2800	C C+	1520 1518	1555 1536	90.0 220.0	810 1750	160	-22.+15 +23.+16	
16	4/09	0215	195	0245	2(3)	N12 W62 5715		42	2h 46m	0800	55	3.1	0140	187	3+	0152 15/3	0247 53/3	2000	C+	0140	0206.5	125.0	1230		M_1.	Also very great bursts at 0500 Mc/s (max intensity 9210) 9400 Mc/s (max intensity 14200) and at 1000 Mc/s (max intensity 18000). The start of this flare was not observed but on the basis of the RF emission it is probable that the flare started sometime before 0140. Consequently a value for Δ t would be questionable. This event was observed by Explorer VII at about 0615 UT.
																		3000	CA	0152	0202.7	64.0	2400			
																		*3750	C+	0140	0202.3	90.0	6000	510		
17	4/29	0107	441	0205	2+(3)	N14 W21 5642		44	2h 43m	0400	114	14.0	0205 0355	-- 175	2+	0214 11/2	0800 65/2	2000	C Storm	0200 0232.5	0207.1 0247.7	20.0 30.0	75 185			Also great bursts 1000 Mc/s at 0139, max. at 0207.3, 3000 peak flux Δ t=+2.3. Seven of the 13 observatories reported max. ranging from 0205 UT. It is evident that the flare as well as the an RF bursts are double events. Value for Δ t questionable.
																0417 8/2	0350 55/3	3750	C+ C C+	0356 0139 0201 0356	0427.4 0140.0 0207.3 0359.7	50.0 9.0 70.0 55.0	370 115 37 365			
18	9/03	0037	77	0108	2+(3)	N18 E88 5838		48	4h 29m	0500	89	2.7	0045	126	3+	0102 22/1	0038 18/-	2000 3000 *3750	C C+ C	0035 0059 0039	0105.2 0105.0 0104.6	30.0 50.0 89.0	7100 9800 12000	160	- 2.8 - 3.0 - 3.4	Also great bursts at 9500, 9400, and 1000 Mc/s with peak fluxes 7400, 14700, and 3770 respectively, Δ t = 0, 0, and -2.4 respectively. The Type II emission was observed at 30 to 22 Mc/s only.
19	11/20	*1955 2114	37 104	2020 2135	1(3) 2(3)	N29 W90 N28 W90 5925		51	6h 14m	0800 11/21	51	3.0	2023	82	3-	2028 7/3	2027 19/2	*2800	C	2023	2026.5	47.0	400	25	+ 6.5	These two flares occurred in the large (max area 1775) magnetically complex ($\beta\gamma$) sunspot group 15119 two days after it crossed the west limb of the sun. On the basis of the radio emissions the PCA and small sea level effect is probably associated with the flare at 1955 UT.
	1961																									
20	9/10	1555 *1950	62	1610 2010	1 1	N10 W90 S08 W80 6212		56	4h 09m	2000 2100 *2300	79	2.9	1942	101	3	1947 27/3	1937 40/3 20/3 101/1*	*2800	C	1930	2001	61.0	880	95	- 9 ±	The association of this PCA which was observed by the Riometers at Ft. Yukon and College, also Δ f-min on the records at Resolute Bay starting at about 2000 UT. The Δ f-min data from Antarctica stations at Byrd and South Pole show the PCA in progress before 2100 UT. Krimigis and Van Allen observed an increase in proton with E > 23 and 40 Mev, at about 2036 UT. The SWF and RF emissions indicate that the flare which started sometime before 1950 was the source of the PCA which started sometime before 2030 UT.
	1962	None																								
	1963																									
21	9/20	2314	167	2403	2	N10 W09 0964		58	0h 46m 1h 06m	2400 21/0020	86	4.6	2351	214	3	2400 26/2 2403 12/3	2410 45/3	2000 *3750	C F C+ C+ C C	2350 2405 2500 2350 2429 2500	2358.4 2430.4 2517.4 2400.3 2432.7 2515.2	15.0 55.0 55.0 23.0 6.0 45.0	1200 880 2100 1400 330 5350		- 4.6 -27.4 +76.4 - 2.7 +29.7 +72.2	

TABLE 3
VERY SMALL PCA EVENTS ASSOCIATED WITH IMPORTANCE
≤3 FLARES AND RF EMISSIONS < 500×10^{-22} W(m²s/c)⁻¹

Date	Start	Duration	Max.	Imp.	Position	PCA No.	Start	Int.	SWF Onset	SWF Dur.	SWF Imp.	II	IV	f	Type	Onset	Max.	Dur.	Int.	Δt
1956																				
4/27	1546			1+	S14 E14	S2	2000	Weak	None reported					2800	SD	1544	--	5.0	6	
	2050	60	2100	1+	N16 W27		2200		2053	24	SL 1+					2051	2056	10.0	375	-4
1957																				
4/05	1433	13	--	1	S15 W90	S4	06/0800	3.2	1408	32	SL 2			2800	CD	1407	1411.5	12.0	50	
	1444	3		1	S20 E35				None											
	1511	15		1	S14 E90				None											
4/06	0550	135		2	N23 W72				None											
4/11	1722	88	1738	2+	S23 E04	S5	12/0120		1731	64	S 3			2800	SD	1725		75.0	16	
															CA	1729.5	1733	16.0	135	-5
7/28	1346	72	1405	2	S23 W82	S7	1500	Weak	None reported					2800	SD	1353.2	1354.1	40.0	18	-10.9
9/22	0558	77	0614	1+	N10 W13	S8	1000							2000	CD	0643	0650	10.0	42	-2
	*0636	49	0652	1	N08 W34									2980	SD	0645	--	10.0	400	
	0643	17	--	1+	N24 W32									3750	CD	0642	0650	11.0	174	-2
	0732	60	0750	2	N23 W38				0746	74	S 2+									
11/04	0058	18	0102	1	S20 W38	S9	05/0030	2.6	None reported											
	0937	27	--	1	S12 W20		0200													
	1058	26	--	1	S24 W39									2980	SD	1059.5	--	1.5	250	
	1735	15	1740	1-	S25 W45															
	1949	10	1949	1-	N23 W58															
1958																				
3/10	2024	64	2034	2	S12 W50	S12	11/0400	Weak	2025	30	G 1			2800	SD	2024	2035	90.0	10	
																2028	2032.5	7.0	72	
3/11	0030	>12	0034	1	N11 E02				0048	152	S 3			2000	CD	0020	0026.7	37.0	187	
														3000	CD	0021	0024.8	38.0	406	
														3750	CD	0020	0024.7	32.0	80	-9.3
3/14	0816	54	0846	1+	N07 W18	S13	2200	Weak												
	0920	21	0927	1+	N08 W19															
	1000	60	1020	1	N07 W22															
	1136	24	1143	1	N07 W19															
	*1454	47	1507	2	S21 W85				1455	130	SL 3		(1453)	1500	CD	1453	1455	--	137	
														2800	CD	1458.5	1501	13.0	210	-6
														3000	CD	1458	1501	34.0	375	-6
1959																				
9/01	1359	51	1410	2	S12 W51	S18	02/0400	VS							SD	1418	1440	45.0	9	
	1419	31	1424	1	N10 W12										SA	1419.3	1420	2.0	30	
	1422	53	1431	1	N14 W68									2800	SD	1645	--	146.4	20	
	1648	104	1704	2+	S12 W52										CA	1658	1706	18.0	70	
	*1923	173	1938	2+	N12 E60							1939	1914		*SD	1928	2023	>212.0	50	+45
	1947	43	1953	1+	N09 W15				1945	73	SL 2	6/3	36/3		*CA	1932	2009	41.5	45	+31
1960	None																			
1961																				
11/10	1121	23	1136	1	N09 W90															
	1328	37	1332	1	N09 W90															
	*1434	16	1444	1+	N19 W90	S21	1500	2 db				1433	1440	1500	C	1430	1435.3	10.0	~47	-8.7
												36/3	63/3	2800	C	1428	1444	38.0	124	0
																1430	1433.5	10.0	11	
1962																				
2/01	0901	289	0907	2	N10 W36	S22	2030	1-2 db												
	1230	16	--	1	N10 W34															
	1552	33	1556	1	N09 W38									2800	S	1550	1554	20.0	3	
	1634	64	1649	1	N09 W38				1657	23	S 1+			2800	S	1636	1640	5.0	8	
1963																				
4/15	1034	116	1125	2	S11 W06	S23	1200	Moderate	1124	16	S 2	No observations		1500	C	1123	1124.7	47.0	30	-0.3
						Resolute Bay McMurdo	f_{min}							2800	S	1123	1124.5	9.0	220	-0.5

* Probable Flare

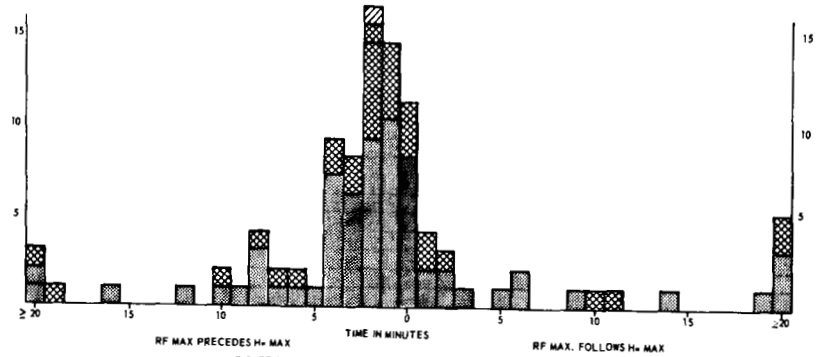


FIGURE 1a FLARES IMPORTANCE ≤2, NOT FOLLOWED BY A PCA

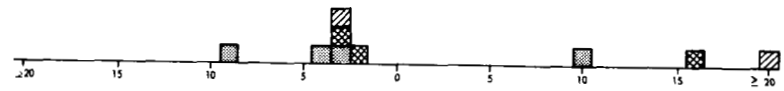


FIGURE 1b FLARES IMPORTANCE ≤2, FOLLOWED BY AN IMPORTANT PCA

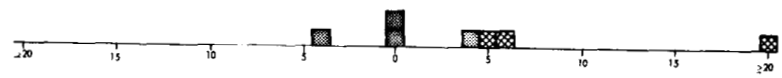


FIGURE 1c FLARES IMPORTANCE ≤2, FOLLOWED BY A SMALL OR DOUBTFUL PCA

FIGURE 1 DELAY TIME (t) BETWEEN H∝ FLARE MAXIMUM AND RF PEAK INTENSITY
FLARES IMPORTANCE ≤2, WITH RF PEAK FLUX ≥500 X 10^{-22} W $(m^2 c/s)^{-1}$
PERIOD 1954 THROUGH 1963, RF FREQUENCY 1420 THROUGH 3750 Mc/s.

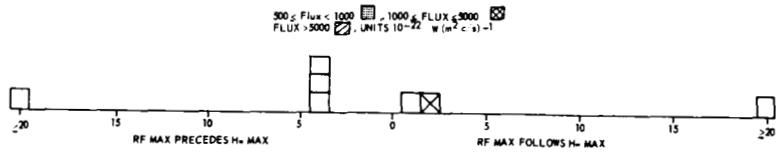


FIGURE 1d FLARES IMPORTANCE ≤2+, FOLLOWED BY A PCA, FLUX <500 X 10^{-22} W $(m^2 c/s)^{-1}$

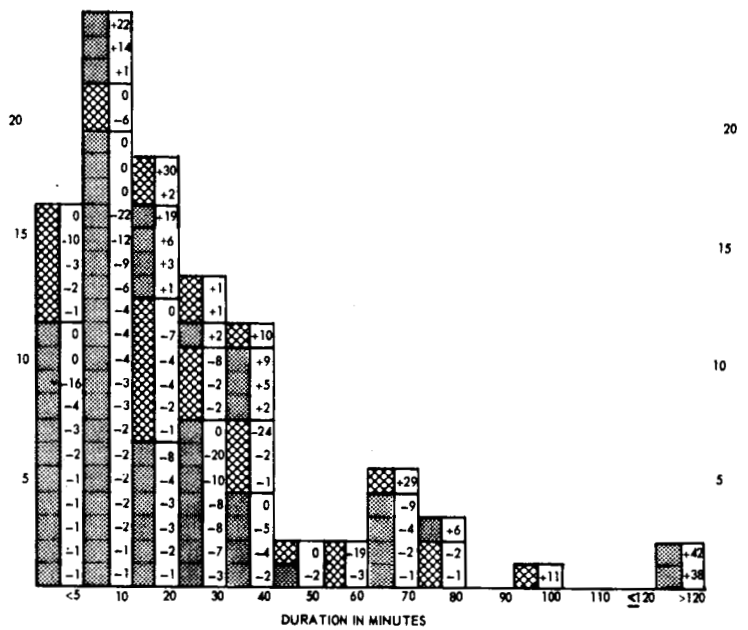


FIGURE 2a NOT FOLLOWED BY A KNOWN PCA

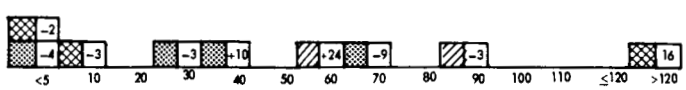


FIGURE 2b FOLLOWED BY AN IMPORTANT PCA

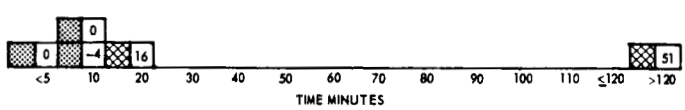
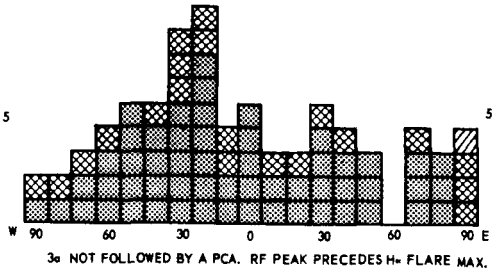


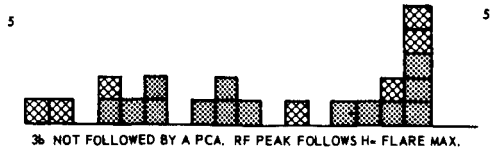
FIGURE 2c FOLLOWED BY SMALL OR QUESTIONABLE PCA

FIGURE 2 DURATION OF RF BURSTS FLARES IMPORTANCE ≤2+ WITH RF PEAK FLUX ≥500 X 10^{-22} W (m^2 c/s)-1

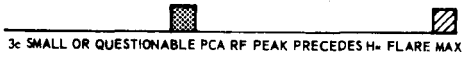
Numbers to the Right of each Column give the Delay time (Δt) in Minutes.



3a NOT FOLLOWED BY A PCA. RF PEAK PRECEDES Hα FLARE MAX.



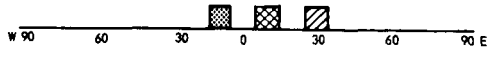
3b NOT FOLLOWED BY A PCA. RF PEAK FOLLOWS Hα FLARE MAX.



3c SMALL OR QUESTIONABLE PCA RF PEAK PRECEDES Hα FLARE MAX

3d SMALL OR QUESTIONABLE PCA RF PEAK FOLLOWS Hα FLARE MAX

3e FLARE FOLLOWED BY A PCA RF PEAK PRECEDES Hα FLARE MAX.



3f FLARE FOLLOWED BY PCA RF PEAK FOLLOWS Hα FLARE MAX.

FIGURE 3. SOLAR DISK DISTRIBUTION OF IMPORTANCE $\leq 2+$ FLARES WITH RF PEAK FLUX $\geq 500 \times 10^{-22}$ W $(m^2\ c/s)^{-1}$

RF Bursts $500 \leq$ FLUX < 1000
$1000 \leq$ FLUX ≤ 5000
FLUX > 5000

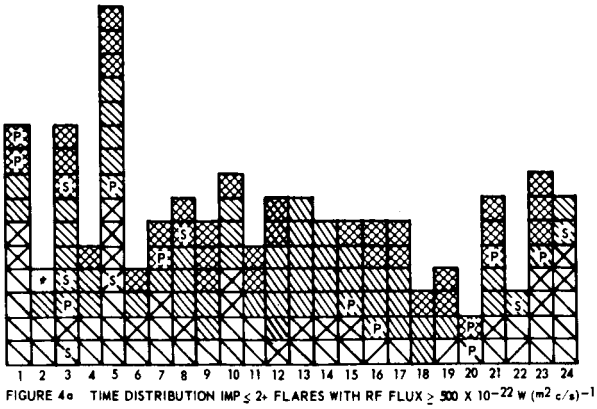


FIGURE 4a TIME DISTRIBUTION IMP ≤ 2+ FLARES WITH RF FLUX ≥ 500 X 10^{-22} W (m^2 c/s)$^{-1}$

Letter P Indicates an Associated Important PCA
Letter S Indicates an Associated Small or Questionable PCA
* Importance 3 not reported in the IAU Bulletin

FIGURE 4.b. TIME DISTRIBUTION RF FLUX ≥500 X 10^{-22} W (m^2<s)$^{-1}$
NO FLARE PATROL OR NO FLARE REPORTED

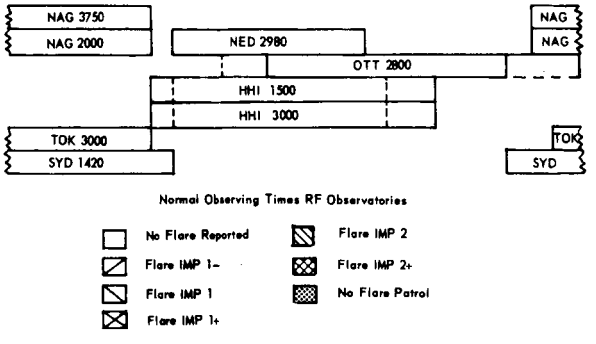


FIGURE 4 TIME DISTRIBUTION RF BURSTS ≥ 500 X 10^{-22} W (m^2 c/s)$^{-1}$ WITH ASSOCIATED FLARE IMPORTANCE

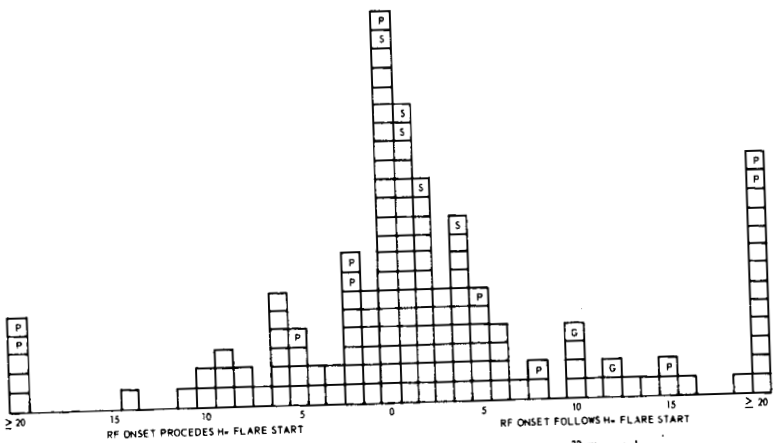


FIGURE 5 FLARES IMPORTANCE ≤2+ WITH RF PEAK FLUX ≥500 X 10^{-22} W/(m² c/s)⁻¹, TIME MINUTES FROM START OF THE FLARE TO START OF RF EMISSION.

Followed by an Important PCA — P
Followed by a Small or Questionable PCA — S
PCA Reported by Gregory only — G
No known PCA

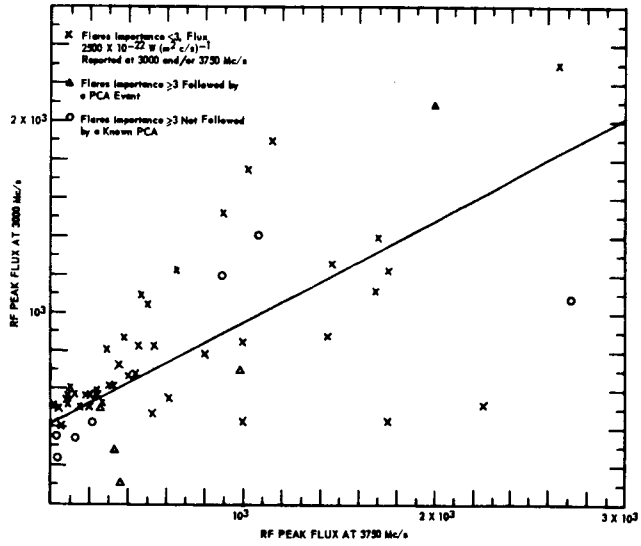


FIGURE 6A – COMPARISON OF RF BURST EMISSIONS AT 3000 Mc/s REPORTED BY TOKYO, AND 3750 Mc/s REPORTED BY NAGOYA

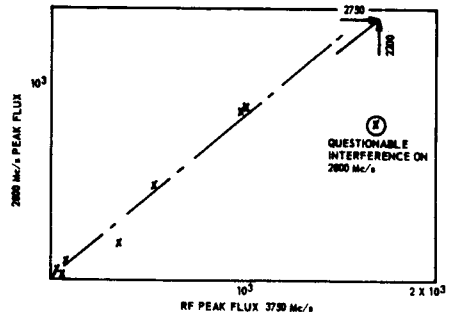
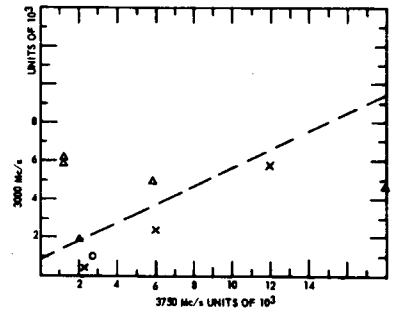


FIGURE 6B COMPARISON OF RF BURST AT 3000 Mc/s AND 3750 Mc/s WITH LEAST SQUARES FIT



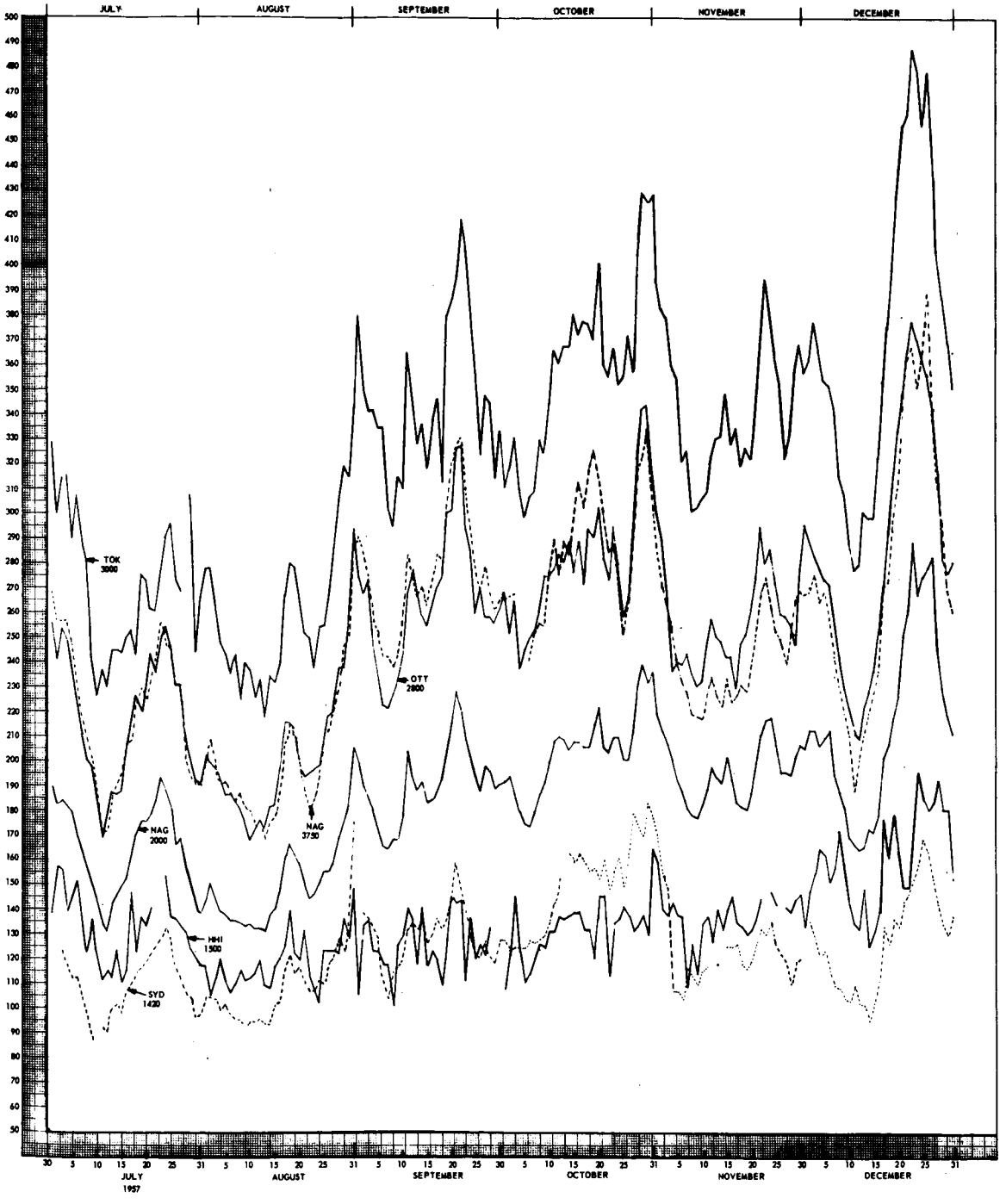


FIGURE 7 COMPARISON OF THE DAILY MEAN RF FLUX AT THE SIX PRINCIPAL FREQUENCIES FOR THE FIRST SIX MONTHS OF THE IGY, INCLUDING THE PERIOD OF SOLOR MAXIMUM

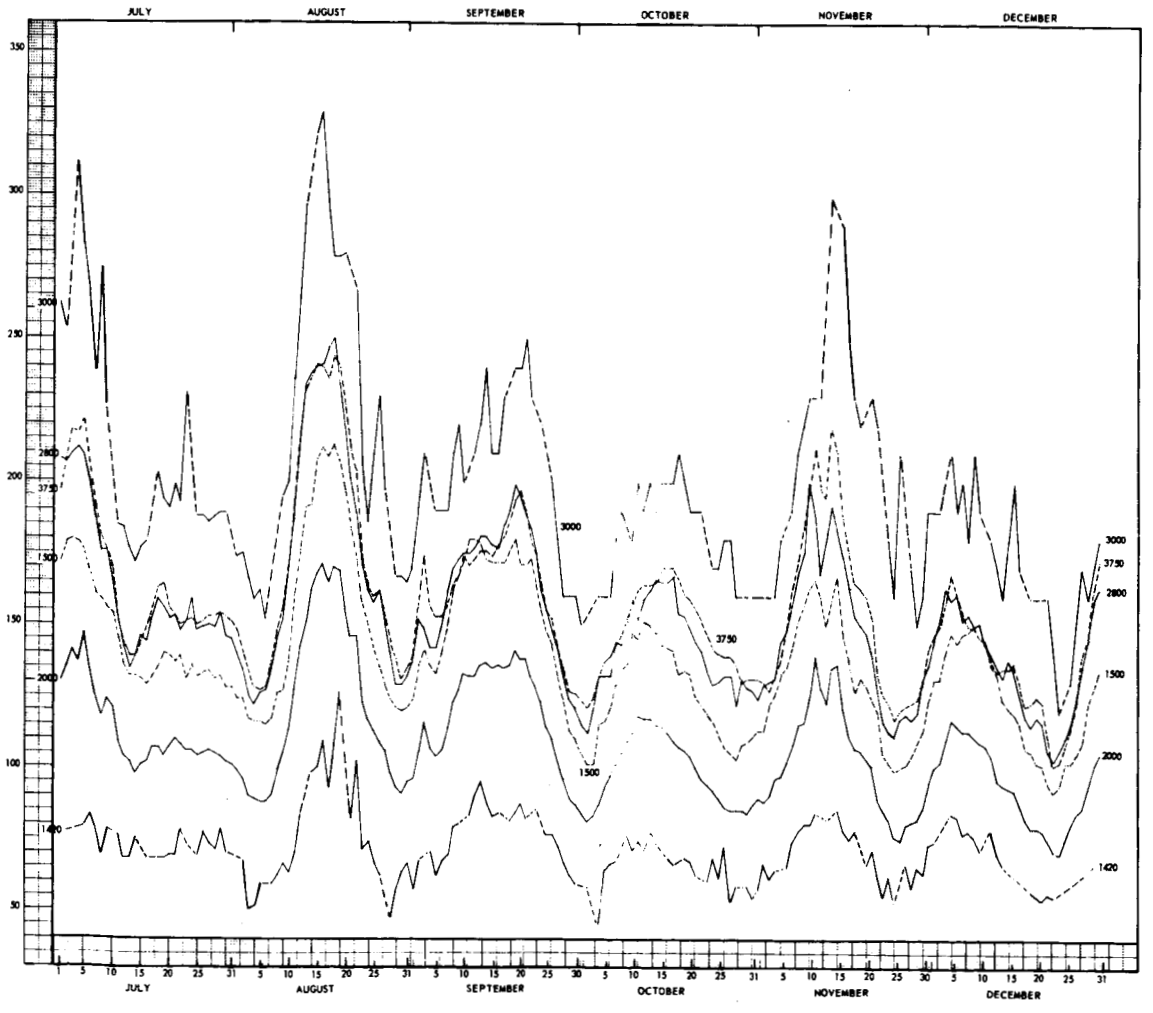


FIGURE 8 COMPARISON OF THE DAILY MEAN RF FLUX AT THE SIX PRINCIPAL FREQUENCIES DURING THE DECLINE OF THE SOLAR CYCLE JULY THROUGH DECEMBER 1960